Editorial

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On Mite Allergy in Dogs and Humans

Enrique Fernández-Caldas

Inmunotek S.L., Madrid, Spain, and University of South Florida College of Medicine, Tampa, Fla., USA

Dust mites are the leading cause of allergy/asthma in humans. In dogs, sensitization to mite allergens seems to be more prevalent than sensitization to flea allergens. An estimated 30–80% of atopic dogs and cats have positive skin tests to dust mites and/or storage mites. In dogs, mite allergens play an important role in the pathogenesis of atopic dermatitis [1]. Atopic dermatitis may affect 3–15% of the dog population. Immediate skin test reactivity to crude mite extracts is very common in dogs with clinical manifestations of atopic dermatitis. Skin test reactions are much more frequent to *D. farinae* extracts (18–80%) than to *D. pteronyssinus* (2–22%) [2]. This occurs even in areas where *D. pteronyssinus* is more common than *D. farinae*. Group 15 and 18 allergens of *Dermatophagoides* spp. are the most important allergens for atopic dogs. Der f 15 (99–109 kDa) has been shown to bind IgE in almost all atopic dogs [3] and Der f 18 (60 kDa) in 79%, in varying quantities [4]. The binding to Der f 15 is strong, and nearly all sera show specific IgE binding at a similar intensity to a complete *D. farinae* extract, suggesting that Der f 15 is a major allergen. In contrast, atopic dogs do not seem to recognize Der p 1, Der p 2, Der f 1 or Der f 2. These major allergens in humans are not major allergens in dogs with atopic dermatitis. Several reasons may account for this discrepancy. Key issues remain unexplored in determining the main route of sensitization in dogs as compared with humans. It is accepted that the main route of sensitization in humans is inhalation and, to a minor extent, through ingestion or contact [5]. Although dogs are also exposed to house dust mite allergens indoors, the ingestion route seems relevant as well, since it has been demonstrated that dog food is regularly contaminated with mites, especially storage mites [6]. Furthermore, there is the added peculiarity that dog-specific IgE preferably binds to *D. farinae* allergens. A described inherent difference between both species is the greater presence of endotoxin in *D. farinae* than in *D. pteronyssinus* cultures [7]. Overall, several reasons may account for these observed discrepancies between dogs and humans. They include the route of sensitization (ingestion or inhalation), shock organ (mainly skin in dogs and the lung in humans), genetic and immunologic differences and predispositions, allergen load (ingested versus inhaled), contact with intestinal and ectoparasites (much more frequent in dogs) and nutritional/hygiene habits.

Dogs tend to react with a greater frequency to chitinase and chitinase-like allergens, like group 15 and 18 mite allergens. Chitin is the second most abundant polysaccharide in nature. It is found in fungal cell walls, in the exoskeletons of crustaceans and insects and in the microfilarial sheaths of parasitic nematodes. Chitinases are induced during infection with these agents. Chitin coats provide protection for pathogens from harsh conditions inside the host. Chitin accumulation is regulated by the balance of chitin synthase-mediated biosynthesis and degradation by chitinases [8]. Chitinases catalyze the hydrolysis of N-acetyl-D-glucosamine 1,4-β-linkages in chitin polymers. They are essential for the arthropod life cycle by aiding the digestion of the exoskeleton during moulting. Chitinases are also important for arthropod gastrointestinal epithelia, where they are needed for the maintenance of the tissue and the digestion of chitin-containing nutrients, which, for mites, include chitin-coated dung balls [9]. Chitin is an important component of the exoskeleton of arthropods and of the egg shell in nematodes. Therefore, it may be a useful target for drugs against ectoparasitic crustaceans, insects and endoparasitic nematodes. Consequently, the effect of chitin meta-

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Correspondence to: Prof. Enrique Fernández-Caldas
Inmunotek S.L.
Avenida Somosierra, 22, N14A, S. Sebastián de los Reyes
ES–28700 Madrid (Spain)
E-Mail efcaldas@inmunotek.com

bolic effectors on the population increase of stored product mites has been tested, demonstrating that diflubenzuron and calcofluor suppress the growth of all tested mite species [10, 11]. It has also been demonstrated that chitin is a potent adjuvant [12] that induces adaptive T-helper cell type 2 (Th2), Th1 and Th17 immune responses. The adjuvant properties of chitin are mediated by a pathway(s) that involves and is regulated by TLR-2, MyD88 and IL-17A [13]. Although chitin itself does not exist in humans, chitinases are present in the human genome. Acidic mammalian chitinase is induced via a Th2-specific, IL-13-mediated pathway in epithelial cells and macrophages in an aeroallergen asthma model. It is expressed in large quantities in human asthma [8].

The study by Hales et al. [14] raises several important points, including the role of chitinases in dog dermatitis, the selection of cut-off limits to determine a positive reaction, to be able to compare different studies, and geographical differences in specific IgE determinations. An important issue raised is the indistinct use of mite extracts for the diagnosis and treatment of mite allergies in humans and dogs. It seems that a reevaluation of the extracts for domestic animals and humans is necessary. This study was part of a project to assess house dust mite allergens for their use in component-resolved diagnosis. It demonstrates that the prevalence of sensitization to Der p 15 and Der p 18 in humans is much lower than previously described, in part due to cut-off criteria. However, it seems reasonable, from the available literature, that these allergens should be present when treating or diagnosing dogs. Treating or diagnosing dogs with the available extracts may result in negative or equivocal results. The presence of similar allergens should also be investigated in other allergenic sources, such as parasites, insects and crustaceans. Establishing the concentration of these molecules in mite allergen extracts and house dust seems necessary. Understanding the reason why men and dogs do not recognize group 15 and 18 allergens in the same manner might be important to identify key mechanisms of allergen host interactions that increase their propensity to induce Th2 responses [14]. Further studies of the immune responses and innate immune reactions in dogs and humans using purified and recombinant allergens could help elucidate the underlying reasons for these phenomena. The finding that human specific IgE binding to Der p 15 and Der p 18 correlated with each other, but not with the other allergens, such as groups 1 and 2, suggests they are a distinct category of allergens that should be included in such investigations. In the same way as specific IgE binding to Der p 10 varies in different regions of the world, sensitization to groups 15 and 18 should be further evaluated in other geographical regions. Studies determining sensitization rates to recombinant Der p 15 and Der p 18 in dogs should also be conducted.

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